Site Need Statement

General Reference Information

1 *	***Need Title:*** Reactive Barriers to Contaminant Migration
2 *	***Need Code:*** RL-WT061
3 *	***Need Summary:*** Although the single- and double-shell tanks store a broad range of highly radioactive isotopes, a few relatively mobile constituents dominate the risk to human health and the environment. For the vadose zone groundwater pathway based on past analysis the list typically includes technetium-99, iodine-129, selenium-79 and uranium. The relative importance of these constituents varies depending on assumptions used during the specific analysis. Sixty-seven of the 149 SSTs at the Hanford Site are known or suspected leakers. Retrieval of waste from these tanks will incur risk from additional leakage. In addition, waste that has been retrieved will be processed, vitrified and disposed in solid form. Based on past analyses, this waste may add radionuclides to the soil column. For example, the performance assessment activities supporting the disposal of vitrified low-activity waste identified technetium-99 and selenium-79 as the radionuclides that contributed most significantly to long-term risk. If these key radioactive elements could be trapped or immobilized in the waste matrix, disposal facility, closed tanks, and/or the soil column, the risk to human health and the environment could be significantly reduced. It is proposed that sequestering agents be deployed as a permeable flow-through (reactive) barrier to attenuate the migration of these contaminants and reduce the risk. In the case of contaminated soil, the reactive barrier will be placed using conventional emplacement technology, e.g., slant drilling, etc. For the vitrified waste and for tank closure, it is proposed that the getter could be placed inside the facility. For existing waste sites, the material may need to be injected into the soil underlying the facility. The same Needs Statement has been submitted to both the Subsurface Contaminants and Tank Focus Areas. A similar Needs Statement has been submitted by the Retrieval Projects effort as RL-WT027.
4 *	***Origination Date:*** FY 2000
5 *	***Need Type:*** Technology Need
6	***Operation Office:*** Office of River Protection (ORP)
7	***Geographic Site Name:*** Hanford Site
8 *	***Project:*** Retrieval, Closure, and Disposal **PBS No.:** RL-TW04, TW09, TW11
9 *	***National Priority:*** ___1. High - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule. _X_2. Medium - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays). ___3. Low - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success.
10	***Operations Office Priority:***

Problem Description Information

11	***Operations Office Program Description:*** The overall purpose of the Retrieve and Transfer SST Waste function is to move the waste from the SSTs into preferred storage in the DST system. A primary objective of this function is to develop and test alternative and improved retrieval technologies to past-practice sluicing. As part of this effort Leak Detection Monitoring and Mitigation (LDMM) approaches are being developed for concurrent deployment. To support this effort Cold Test Training & Mock-up Facilities are being established. The baseline end state of the Retrieve and Transfer SST Waste function is: • Retrieval of all wastes from the SSTs • The safe, environmentally compliant transfer of this waste to the DSTs • SSTs in a ready state for implementing closure and final disposal of the SST farms

	The overall purpose of the Disposal function is to provide and operate permitted facilities to disposal of immobilized low-activity waste (ILAW), store and prepare immobilized high-level waste (IHLW) for offsite shipment, and dispose of secondary waste from the tank farms and waste treatment plant (WTP), including failed melters. The overall purpose of the Closure function is to close SST and DST tank farms and RPP facilities. Closure of tanks and tank farms assumes that waste retrieval will remove sufficient waste from the tanks that the residual wastes following retrieval, the tanks themselves, the tank farm ancillary equipment, and the contaminated soil will be disposed in place in accordance with applicable regulations and agreements. This strategy also assumes that the residual waste and other tank farm source terms will be considered by the U. S. Nuclear Regulatory Commission to be incidental waste, i.e., non-high-level waste. This function has substantial involvement with studies directed at understanding contaminant migration in the vadose zone and groundwater that are part of the Hanford Groundwater/Vadose Zone (GW/VZ) Integration Project.
12	***Need/Problem Description:*** Although limited efforts have been performed to identify getter materials (sequestering agents), no material has been sufficiently tested to date to be selected. During the last few years, the list of candidate materials has been reduced. Based on this work, candidate getters include bone char, hydrotalcite, iron-oxyhydroxides, sulfides, magnetite, and oxides. Research to date (performed by both Pacific Northwest National Laboratory and Sandia National Laboratories) suggests magnetite, bone char, and hydrotalcite to be most effective for attenuating technetium. Similarly, hydrotalcite and iron-oxyhydroxides are candidates for attenuating uranium and selenium. Recent efforts as part of the Immobilized Waste Program and by the Tank Focus Area champion have identified some potentially useful materials. This science need supports the Hanford tanks technology need RL-WT061 Reactive Barriers to Contaminant Migration. This need is described in Section 10.3.5 of the Office of River Protection Preliminary Integrated Technology Plan, DOE-ORP-2001-17, Rev 0. **Consequences of Not Filling Need:** Conservative methods and data will be used in the performance assessment, likely requiring more stringent contaminant release specifications in the waste product request for proposal and requiring more expensive disposal facilities. ** **Program Baseline Summary (PBS) No.:** RL-TW04, TW09, TW11 ** **Work Breakdown Structure (WBS) No.:** 5.05.01.01; 5.04.01; 5.02.01.01.02.02 ** **TIP No.:** TIP 0001 (RL-ER01), TIP 0002 (RL-ER02), TIP 0003 (RL-ER03)
13	***Functional Performance Requirements:*** The candidate materials will need to perform over a pH range of from 8 to 12. The material must be low in cost and should be abundant to avoid any attraction as a natural resource by future generations. The chemical distribution coefficient (K_d) should be greater than 100 mL/g. The trapping should be long-term and hence should not be easily reversible in the oxidizing environment at Hanford. **Outsourcing Potential:** Once the laboratories (PNNL and SNL) have performed the laboratory analysis and bench scale demonstrations, the technology will be available for field scale demonstration and deployment. Field scale demonstration and deployment will be outsourced. A number of geotechnical engineering firms that specialize in drilling and grouting are available to supply this expertise. "Landfill" closure of tank farms, i.e., by stabilizing tanks and residual tank waste with fill materials, could easily be outsourced. Incorporation of getters in tank fill materials is considered to be a routine part of such closure operations.
**	**Schedule Requirements:** Based on recent RCRA groundwater assessments, groundwater contamination in some locations has been attributed to tank system leaks. During FY 1999 additional borings were performed in the tank farms to assess inventory and distribution of contaminants in the tank farms vadose zone, and factors that have controlled contaminant movement. Contaminant transport modeling will then be conducted to estimate the benefits of corrective measures that could be employed. Emplacement of a reactive barrier is a corrective measure that may be selected if the technology has been demonstrated. To support future low-activity performance assessments, data is needed by September 2005. The results from the performance assessment will be used during the design of the waste package or disposal facility. To support the planned National Environmental Policy Act (NEPA) process for tank farm closure decisions, data is anticipated to be needed by the end of FY 2004. To support the remediation of other 200 area

	sites, information is needed by 2005.
14	***Definition of Solution:*** .
15 *	***Targeted Focus Area:*** Tanks Focus Area (TFA) and Subsurface Contaminants Focus Area (SCFA)
16	***Potential Benefits:*** Supports retrieval of potentially, leaking SSTs as well as disposal and closure activities.
17 *	***Potential Cost Savings:*** Hundreds of millions of dollars
18 *	***Potential Cost Savings Narrative:*** The cost savings could be significant. With regard to the disposal facility, the cost savings resulting from lowering the design requirements could exceed several hundred million dollars. The cost saving associated with deployment of the getter material in the soil could approach several hundred million dollars depending on the inventory and distribution of contamination resulting from past and anticipated future leaks (if contaminated soils would otherwise have to be removed to meet long term performance requirements for closed tank farms). The cost savings associated with placement of getter materials in tank fill materials as part of closure could approach several hundred million dollars, if higher levels of tank waste removal, or tank removal, would otherwise be required to meet long term performance requirements for closed tank farms.
**	***Technical Basis:*** Deployment of sequestering agents directly in contaminated soil could provide an engineering solution for past leaks and retrieval leaks. Deployment of sequestering agents in the matrix or as a liner around the vitrified low-activity waste will reduce the engineering requirements of the disposal facility. Deployment of sequestering agents in tank fill materials, as part of tank closure operations, could enhance long term performance of the tank farm closure system. **Other:** Concerns regarding the migration of contaminants from existing subsurface contamination and future leaks from sluicing could impact RPP/ORP retrieval options and limit cleanup and disposal strategies. Mitigation of waste immobilization will rely on the principle of chemical stabilization rather than macroencapsulation or containment.
19	***Cultural/Stakeholder Basis:*** Disposal of low-activity tank waste has the largest impact of any intentional Hanford disposal action. Deployment of the getter material as a reactive barrier in contaminated soil or in tank fill materials will reduce the rate of transport of contaminants to groundwater following tank farm closure, and will thereby reduce long term risk under postulated exposure scenarios that will be evaluated in making decisions on tank farm closure.
20	***Environment, Safety, and Health Basis:*** Deployment of sequestering agents will reduce the long-term risk to both human health and the environment by attenuating the migration of mobile contaminants.
21	***Regulatory Drivers:*** Performance assessments are required by DOE Order 435.1.
22 *	***Milestones:*** Data Packages for 2005 ILAW PA (2004); Tank Farm RFI Report (2007); 200 Area RFI reports (through 2008)
23 *	***Material Streams:*** Soil (Disposition Map Designations: ER-04: LLW Soils 100/300 Area, ER-14: LLW Soils 200 Area, ER-03: MLLW Soils); Sludge, Salt, Liquid (RL-HLW-20); Soil (Disposition Map Designations: ER-14: LLW Soils 200 Area)
24	***TSD System:*** 200 Area liquid discharge sites; ILAW disposal facility; SST farms; DST farms
25	***Major Contaminants:*** *Tc, I, Se, U, Np, Cr, CCl4*
26	***Contaminated Media:*** Hanford vadose zone
27	***Volume/Size of Contaminated Media:*** The single shell tanks are generally 75 ft. in diameter, and up to 40 feet deep with their tops buried about 10 feet below the ground surface.
28 *	***Earliest Date Required:*** FY 2001
29 *	***Latest Date Required:*** September 2008
Baseline Technology Information	
30	***Baseline Technology/Process:*** The current strategy for closure of Hanford double and single-shell tanks does not include the use of sequestering agents. Although the technology has been proposed for use in support of Environmental Restoration activities on the Hanford Site, the technology has not been deployed at Hanford. However, within the scientific community there is considerable interest in its potential use. The need for sequestering agent technology development has been identified in the ILAW program logic, and was evaluated as an option in Appendix F of the

	"Retrieval Performance Evaluation Methodology for the AX Tank Farm" (DOE/RL-98-72). **Technology Insertion Point(s):** TIP 0001 (RL-ER01), TIP 0002 (RL-ER02), TIP 0003 (RL-ER03)
31	***Life-Cycle Cost Using Baseline:***
32	***Uncertainty on Baseline Life-Cycle Cost:***
33	***Completion Date Using Baseline:***
Points of Contact (POC)	
34	***Contractor End User POCs:*** F.M. (Fred) Mann, CHG., 509-372-9204, F/509-372-9447, Frederick_m_mann@rl.gov
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*Element of a Site Need Statement appearing in IPABS-IS
**Element of a Site Need Statement required by CHG